

# Endosonographic Evaluation of the Adrenal Glands: Part I



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## Abstract

The left adrenal gland is best visualized using endoscopic ultrasound (EUS) from a position in the upper body of the stomach, whereas the right adrenal gland may easily be examined using transabdominal ultrasound. The adrenal glands have a 'seagull' configuration, with a body and two long wings. Sonographically, five layers of the adrenals may be distinguished. Mass lesions are incidentally found in up to 5% of patients, only 15–20% of these 'incidentalomas' being clinically relevant. However, the adrenal glands are the fourth most frequent site of metastases in malignant disease. EUS-guided fine-needle aspiration biopsy of the left adrenal gland has a high yield and very low risk. This article is part of an expert video encyclopedia.

## Keywords

Adrenal gland; Endoscopic ultrasound; EUS-guided fine-needle aspiration biopsy; Standard endoscopy; Video.

## Video Related to this Article

Video available to view or download at doi:10.1016/S2212-0971(13)70062-1

## Materials

- Radial echoendoscopes: EG-3670 URK; Pentax Europe GmbH, Hamburg, Germany.
- Longitudinal echoendoscopes:
  - UCT 140-AL5; Olympus Medical Systems Europe GmbH, Hamburg, Germany.
  - EG-3870 UTK; Pentax Europe GmbH, Hamburg, Germany.
- Fine needles for endoscopic ultrasound (EUS): 25 gauge, 22 gauge, and 19 gauge; Cook Medical, Bloomington, USA; Mediglobe, Achenmühle, Germany; Olympus Medical, Hamburg, Germany; Boston Scientific, Natick, MA, USA.
- High-end ultrasound platforms: HI vision Preirus; Hitachi Medical Systems, Wiesbaden, Germany.
- Aloka Diagnostic Ultrasound System: ProSound alpha 5; ALOKA GmbH, Willich, Germany.

## Background and Endoscopic Procedure

Endosonographic imaging of the adrenal glands was reported for the first time more than 15 years ago.<sup>1</sup> The first description of the EUS and EUS-guided fine-needle aspiration (FNA) of the left adrenal gland was published by Chang *et al.*<sup>2</sup> The adrenal glands have a 'seagull' configuration, with a body and two long wings (lengths up to 50 mm; diameter up to 10 mm). Using modern high-resolution equipment it is now possible to distinguish between the medulla, the cortex, and

the capsule of both adrenals (five-layer structure).<sup>3</sup> Moreover, very small tumors can be identified, and in particular, atrophic adrenals can be demonstrated as a manifestation of autoimmune Addison's disease.<sup>3–5</sup> Imaging characteristics and size alone are unreliable in the classification of benign and malignant adrenal disease. In the German register for endosonography ([www.eus-degum.deum.de](http://www.eus-degum.deum.de)) there are now (August 2012) 20 067 prospectively recorded examinations, including 2726 cases of EUS-guided biopsies. In 100 cases EUS-FNA of the adrenal glands was conducted.

Indications for endosonography of the adrenal glands are<sup>6</sup>:

- Detection of small adrenal tumors.
- Characterization of adrenal tumors.
- Assessing criteria of malignancies in adrenal tumors.
- Early detection of recurrences of malignant adrenal tumors.
- Identification of morphologically healthy parts of the adrenals before resection of adenomas.
- Detection of extra-adrenal tumors.
- Discrimination between different entities in adrenal insufficiency.
- EUS-guided FNA biopsy.

Identification of the right adrenal gland is possible with transabdominal ultrasonography in most healthy individuals. However, visualization of the left adrenal gland is much more reliable using EUS. The left adrenal gland can be examined from a subdiaphragmatic position. Typically, it is seen between the upper pole of the left kidney, pancreatic tail, spleen, crus of the diaphragm, and abdominal aorta. The upper pole of the left kidney, the pancreatic tail, and the splenic vessels serve as guiding structures.

The right adrenal gland can be visualized with EUS in a left-lateral position from the duodenal bulb or from the descending part of duodenum. The upper pole of the right kidney and the inferior caval vein are useful anatomical landmarks. The positioning and complete evaluation of the right adrenal gland from the gastric antrum or the duodenum are significantly more technically difficult. Longitudinal

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echoendoscopes which allow transgastral or transduodenal biopsies of adrenal mass lesions are preferable for examining adrenal glands. In a study by Dietrich, the typical echopattern of the right adrenal gland could be detected in 6 of 20 patients (30%), whereas the left adrenal gland was identified in all the 20 patients.<sup>3</sup>

## Incidentaloma

Incidentally discovered adrenal gland mass lesions without clinically detectable endocrine activity or a current or previous malignancy are referred to as incidentalomas. In an analysis of 25 autopsy studies of a total of 87 065 cases, the cumulative frequency of adrenal incidentalomas was slightly higher than 6%. Only 15–20% of the incidentalomas are clinically relevant (subclinical endocrine active adenomas: Cushing's syndrome 5%; Conn's syndrome 1%; clinically silent pheochromocytomas 5%; metastases 2.5%; primary carcinomas 5%).<sup>1</sup> More than 70% of all adrenal incidentalomas are hormonally inactive benign adrenocortical adenomas. The fundamental endocrinological examination is:

- metanephrine in 24-hour urine collection (or in plasma)
- 1 mg dexamethasone inhibition test
- 24-hour blood pressure
- serum potassium
- in cases of arterial hypertension and/or hypokalemia: renin and aldosterone activity

## Hyperplasia of Adrenal Glands

Diffuse cortical hyperplasia occurs both as a nonspecific finding and in case of idiopathic hyperaldosteronism. Thickening of the adrenal gland >10 mm in combination with reduced or lacking delineation between the echogenic medullary echo and hypoechoic cortex echo are typical endosonographic findings.<sup>6</sup> In addition, nodular hyperplasia occurring in multiple endocrine neoplasia type 1 can be identified.

## Differential Diagnosis of Solid Adrenal Lesions

In cancer patients it is crucial to differentiate between adenomas and metastatic adrenal tumors. Adrenal glands are the fourth most frequent site of metastases in malignant disease. However, in cancer patients approximately 50% of adrenal tumors are benign. Lipid content and enhancement characteristics are two main features in radiological imaging of adrenal lesions which are useful in differentiating adenomas from metastases. Most adenomas (approximately 80%) contain lipids.<sup>7–9</sup>

However, a precise cut-off threshold between benign and malignant lesions has not been established. Since the introduction of EUS–FNA in clinical practice in the early 1990s, many reports have described sampling of various organs adjacent to the gastrointestinal tract, including the adrenal gland.<sup>10–12</sup> This advantage is mostly related to the fact that no

other organ except the gastric or duodenal wall is traversed to access the adrenal glands.<sup>13</sup> The right adrenal gland can also be sampled with EUS–FNA via the duodenal approach, especially when the percutaneous approach is not feasible.<sup>14–17</sup> In summary, in centers where EUS expertise is available, EUS–FNA provides a viable, minimally invasive alternative to adrenalectomy or percutaneous image-guided biopsy of the adrenal glands because it seems to be a safer approach and has an excellent yield for tissue diagnosis. There is some evidence that endosonography of the adrenal glands may be superior to magnetic resonance imaging and/or computed tomography in relation to small adrenal tumors, with postoperative histological assessment being used as the gold standard.<sup>5,10</sup>

## Key Learning Points/Tips and Tricks

- The left adrenal gland is best visualized using endosonography; landmarks are the pancreatic tail, aorta, and the upper pole of the left kidney.
- The right adrenal gland is better explored by percutaneous ultrasound.
- 15–20% of adrenal incidentalomas are clinically relevant.
- EUS–FNA is an alternative to adrenalectomy or percutaneous image-guided biopsy.

## Complications and Risk Factors

The complication rate of EUS is very low (approximately 0.03%).<sup>18</sup> EUS-guided biopsy of the left adrenal gland is an exceptionally safe procedure.<sup>19</sup>

## Scripted Voiceover

Time (min:sec)	Voiceover text
00:00	In this longitudinal scan the cranial part is located to the right of the picture.
00:16	The left adrenal gland can be seen approximately 45 cm from the teeth.
00:27	The gland is surrounded by the upper pole of the spleen, the upper pole of the kidney, and by the left crus of the diaphragm.
00:47	The left adrenal gland can be visualized in almost every case.
00:55	With a radial echoendoscope you can also see the surrounding anatomical structures.
01:10	The organ length is about 50 mm. This is in contrast to the schematic figures in anatomical textbooks.
01:29	The diameter should be less than 10 mm throughout all parts of the gland.
01:44	You can distinguish five different layers. The next images describe every individual layer, these are related to the anatomical structure.

02:10	Three suprarenal arteries and one suprarenal vein provide an independent blood supply.
02:29	An echogenic central echo corresponds to the adrenal medulla.
02:41	On both sides the gland is surrounded by the hypoechoic layer of the adrenal cortex.
02:51	An echogenic capsule structure on the outside of the gland.
03:02	The upper pole of the right kidney and the inferior cava can be found as landmarks for the right adrenal gland. The right adrenal gland is more visible in a percutaneous ultrasound examination in a slightly left-lateral position.
03:38	Incidentally discovered adrenal masses without endocrine activity or without any history of malignancy are defined as incidentaloma.
04:29	The risk of a malignant incidentaloma is comparatively low.
04:48	Only a small portion of the lesion is clinically relevant.
05:07	The vast majority of incidentalomas are benign and nonfunctioning tumors.
05:21	The diagnostic and therapeutic management of incidentalomas are the subject of a controversial scientific and economic debate.
05:37	In this sequence you can see a large adenoma without endocrinological relevance, but the diameter is suspicious. For that reason more diagnostic examinations are needed.
06:00	The endosonographic fine-needle puncture of the left adrenal gland is a safe procedure and can be useful for the evaluation and staging of ominous masses. Only a few cases describe the puncture of the right adrenal gland.
06:31	Therefore, a combined transabdominal and endoscopic ultrasonographic approach is useful for visualization of the adrenal glands. This may enable diagnosis of adrenal masses as well.

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